

CLAIMS

What is claimed is:

1. A method for forming a semiconductor device comprising:
providing a substrate;
forming a predetermined layer on the substrate;
forming a photoresist layer on the predetermined layer; and
exposing the photoresist layer to fluorine to produce a fluorinated photoresist layer.
2. The method of claim 1, wherein the photoresist layer is a patterned photoresist layer.
3. The method of claim 2, further comprising using a scanning electron microscope (SEM) to measure a dimension of a portion of the patterned photoresist layer, wherein the dimension is substantially unchanged by an electron beam emitted by the SEM.
4. The method of claim 3, further comprising etching the portion of the patterned photoresist layer to change the dimension to a smaller dimension.
5. The method of claim 3, wherein the portion of the patterned photoresist layer is for forming a control electrode of a transistor.
6. The method of claim 1, wherein the exposing the photoresist layer to fluorine further comprises exposing the photoresist layer to a gas comprising fluorine.
7. The method of claim 6, wherein the gas is molecular fluorine (F_2) in an inert carrier gas, the inert carrier gas comprising one or more of nitrogen (N_2), helium (He), and argon (Ar).
8. The method of claim 6, wherein a source of the fluorine comprises one or more of nitrogen trifluoride (NF_3), sulfur hexafluoride (SF_6), xenon difluoride (XeF_2), and molecular fluorine (F_2).

9. The method of claim 6, wherein the gas is dissociated into atomic fluorine from one of nitrogen trifluoride (NF₃), sulfur hexafluoride (SF₆), xenon difluoride (XeF₂), and molecular fluorine (F₂) via a plasma.
10. The method of claim 1, wherein the exposing the photoresist layer to fluorine further comprises exposing the photoresist layer to a liquid comprising fluorine.
11. The method of claim 10, wherein the liquid comprises one or more of 1-fluoro-4-hydroxy-1,4-diazoniabicyclo[2.2.2]octane bis(tetrafluoroborate), N-fluoropyridinium pyridine heptafluorodiborate, and N-fluorobenzenesulfonimide.
12. The method of claim 1, wherein the predetermined layer comprises one of a conductive material, a semiconductive material or an insulating material.
13. A semiconductor device comprising:
 - a substrate;
 - an insulating layer formed over the substrate;
 - a conductive layer formed over the insulating layer; and
 - a photoresist layer formed over the conductive layer, the photoresist layer being exposed to fluorine after being formed on the conductive layer.
14. The semiconductor device of claim 13, wherein the photoresist layer is a patterned photoresist layer.
15. The semiconductor device of claim 13, wherein the conductive layer is formed using one or more of a group consisting of metal, silicon, and germanium.
16. The semiconductor device of claim 1, wherein the fluorine is in a gaseous form.
17. The semiconductor device of claim 16, wherein the fluorine is dissociated from one of nitrogen trifluoride (NF₃), sulfur hexafluoride (SF₆), xenon difluoride (XeF₂), and molecular fluorine (F₂).

18. The semiconductor device of claim 17, wherein the fluorine is dissociated via a plasma.
19. The semiconductor device of claim 16, wherein fluorine is in a liquid form.
20. The semiconductor device of claim 19, wherein the liquid comprises one or more of 1-fluoro-4-hydroxy-1,4-diazoniabicyclo[2.2.2]octane bis(tetrafluoroborate), N-fluoropyridinium pyridine heptafluorodiborate, and N-fluorobenzenesulfonimide.
21. An apparatus for making a semiconductor device, the semiconductor device including a substrate, an insulating layer formed on the substrate, a conductive layer formed on the insulating layer, and a photoresist layer formed on the conductive layer, the apparatus comprising a fluorination module, the fluorination module for exposing the photoresist layer of the semiconductor device to fluorine.
22. The apparatus of claim 21, wherein the fluorination module is for exposing the photoresist layer to fluorine after the photoresist layer is patterned.
23. The apparatus of claim 21, wherein the fluorination module is for exposing the photoresist layer to a gas comprising fluorine.
24. The apparatus of claim 21, wherein the fluorination module is for exposing the photoresist layer to a liquid comprising fluorine.